

# Bootup and Initialization

Produced and directed by the Linux operating system

David Morgan

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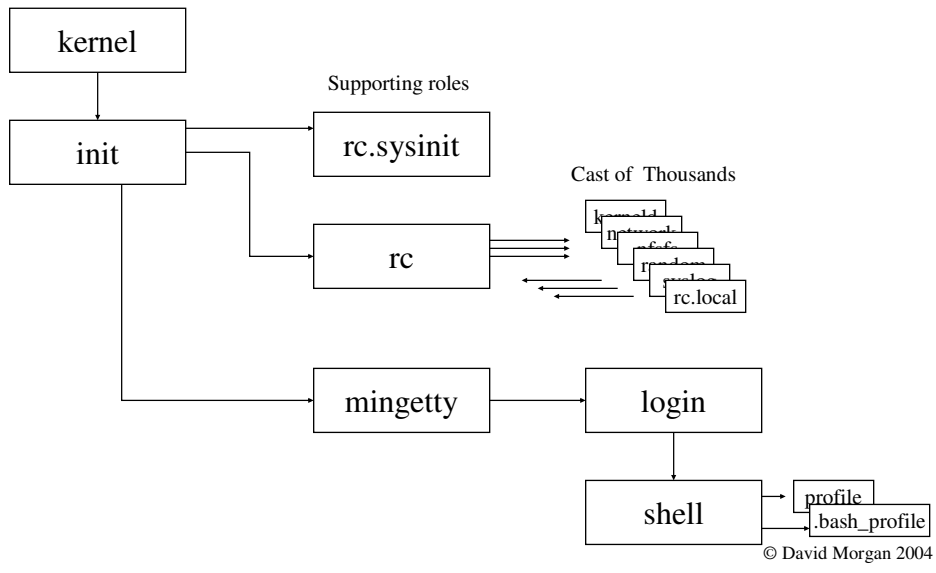
## Members of the Cast

- Starring roles
  - The kernel
  - The init process
- Supporting roles
  - `/etc/rc.d/rc.sysinit`
  - `/etc/rc`
  - `/sbin/mingetty`
- Cast of thousands
  - links in `/etc/rc.d/rc?.d`
    - to scripts in `/etc/rc.d/init.d`
    - to `/etc/rc.d/rc.local`

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# A Play in Several Acts

Starring roles



## Starring role: Kernel

- Kernel code loads
  - From floppy with no filesystem
    - starting from first sector
  - From floppy or hard disk with filesystem
    - from a file, e.g., /boot/vmlinuz
- Identifies/initializes hardware
- Displays/stores messages
- Invokes init process

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## Starring role: init Process

- Father of all processes
  - init is to process structure as root is to file structure
  - always PID number “1”
- Creates other processes
- According to `/etc/inittab`
  - `sysinit`          system boot process(es)
  - `initdefault`      runlevels for process selection
  - `wait`              processes to run
  - `respawn`          processes to run and rerun

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## `/etc/inittab` lineitem format

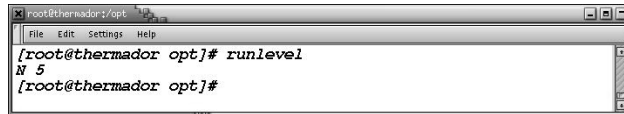
### ● **id : runlevels : action : process**

- `id`                  lineitem identifier
- `runlevels`        for which ones to run process
- `action`            when to run process
- `process`          program to run

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# Runlevels

- Runlevel – a system configuration allowing only selected processes to exist
- 0 halt
- 1 single user mode
- 2 multiuser
- 3 full multiuser
- 4 unused
- 5 X11 (GUI)
- 6 reboot



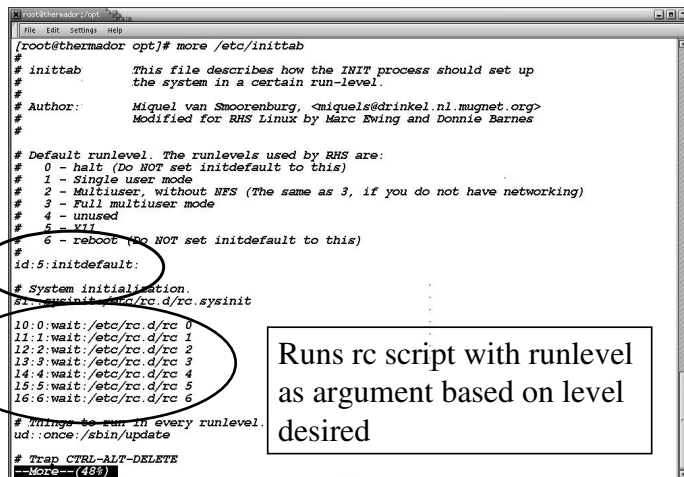
```
root@thermador:/opt
[root@thermador opt]# runlevel
N 5
[root@thermador opt]#
```

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# /etc/inittab

default run level is 5 here (boot to GUI)

What happens if default is 3?



```
root@thermador:/opt
[root@thermador opt]# more /etc/inittab
#
# inittab      This file describes how the INIT process should set up
#             the system in a certain run-level.
#
# Author:     Miquel van Smoorenburg, <miquels@drinkel.nl.mugnet.org>
#             Modified for RHS Linux by Marc Ewing and Donnie Barnes
#
# Default runlevel. The runlevels used by RHS are:
# 0 - halt (Do NOT set initdefault to this)
# 1 - Single user mode
# 2 - Multiuser, without NFS (The same as 3, if you do not have networking)
# 3 - Full multiuser mode
# 4 - unused
# 5 - X11
# 6 - reboot (Do NOT set initdefault to this)
#
id:5:initdefault:
# System initialization.
#1:sysinit:/etc/rc.d/rc.sysinit
#2:wait:/etc/rc.d/rc 2
#3:wait:/etc/rc.d/rc 3
#4:wait:/etc/rc.d/rc 4
#5:wait:/etc/rc.d/rc 5
#6:wait:/etc/rc.d/rc 6
# Things to run in every runlevel.
ud::once:/sbin/update
# Trap CTRL-ALT-DELETE
--More--(48)
```

Runs rc script with runlevel as argument based on level desired

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## Supporting role: rc.sysinit

- Starts swapping
- Sets hostname
- Mounts filesystems
- Loads modules
- Other initialization
- (rc = run commands)

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## Supporting role: rc

Loops thru

all /etc/rc.d/rc?.d/K\*

calls each with parameter “stop”

- stops it if it's running -

all /etc/rc.d/rc?.d/S\*

calls each with parameter “start”

- runs it if it's stopped -

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## Cast of 1000s: /etc/rc.d/rc?.d/S\*

Directory full of symbolic link “pointers”

```
S01kerneld -> /etc/rc.d/init.d/kerneld start
S10network ->/etc/rc.d/init.d/network start
S15nfsfs ->  /etc/rc.d/init.d/nfsfs start
S20random -> /etc/rc.d/init.d/random start
S30syslog -> /etc/rc.d/init.d/syslog start
S40atd ->    /etc/rc.d/init.d/atd start
.
.
.
```

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## rc script's effect

Runs scripts in init.d directory

```
/etc/rc.d/init.d/kerneld start
/etc/rc.d/init.d/network start
/etc/rc.d/init.d/nfsfs start
/etc/rc.d/init.d/random start
/etc/rc.d/init.d/syslog start
/etc/rc.d/init.d/atd start
.
.
.
```

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## init.d script template

```
# /etc/rc.d/init.d/xyz
```

```
# see how we were called
```

```
With "start" argument
```

```
    display "Starting xyz daemon"
```

```
    start the xyz daemon
```

```
With "stop" argument
```

```
    display "Stopping xyz daemon"
```

```
    kill the xyz daemon
```

(how to write an init script: /usr/share/doc/initscripts-[xxx]/sysvinitfiles)

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## Kudzu – one of the init scripts

If it runs:

“Checking for new hardware” message indicates kudzu "Plug and Play" hardware detector is running

Checks current hardware against existing list at  
/etc/sysconfig/hwconf

If anything is different you are prompted to either add or remove the device as appropriate; /etc/sysconfig/hwconf updated accordingly

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## Your chance to shine: rc.local

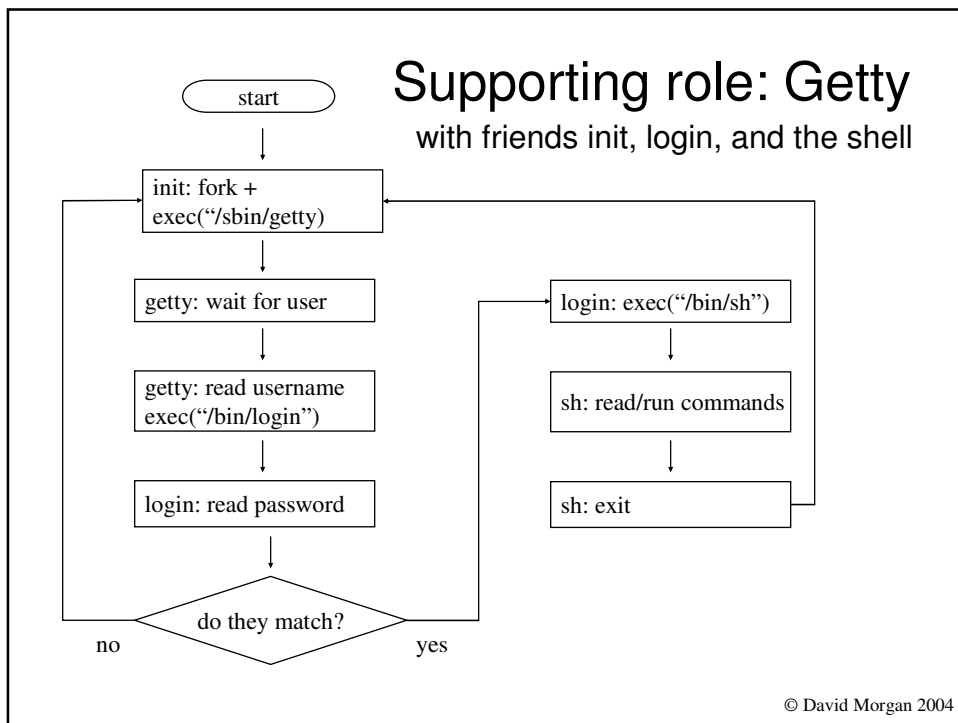
- Machine-specific startup code
- Put changes here, not rc.sysinit or rc

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## Post-bootup Initialization

- Bootup is now complete
- Getty is running
- Further initialization: if someone logs in
  - getty calls login (/bin/login)
  - login calls “the shell” (/bin/sh = /bin/bash)

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## Shell Startup Files

- Executed by shell when started by login
- `/etc/profile`, runs 1st
  - universal settings, all users
- `/home/username/.bash_profile`, runs 2nd
  - settings specific to user “*username*”

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